MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

PEM0026 – TRIGONOMETRY AND GEOMETRY

(Foundation in Engineering)

13 MARCH 2020
3.00 p.m. m. – 5.00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **4** pages including the cover page and appendix.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown.

4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

TRIGONOMETRY IDENTITIES

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B$

$\cos(A\pm B)=\cos A\cos B\mp\sin A\sin B$

$\tan(A\pm B)=\dfrac{\tan A\pm\tan B}{1\mp\tan A\tan B}$

$2\sin A\cos B=\sin(A+B)+\sin(A-B)$

$2\cos A\cos B=\cos(A+B)+\cos(A-B)$

$2\sin A\sin B=\cos(A-B)-\cos(A+B)$

$\sin A+\sin B=2\sin\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\sin A-\sin B=2\cos\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\cos A+\cos B=2\cos\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\cos A-\cos B=-2\sin\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\sin^2\dfrac{A}{2}=\dfrac{1-\cos A}{2}$; $\cos^2\dfrac{A}{2}=\dfrac{1+\cos A}{2}$; $\tan^2\dfrac{A}{2}=\dfrac{1-\cos A}{1+\cos A}$

$\sin\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{2}}$; $\cos\dfrac{A}{2}=\pm\sqrt{\dfrac{1+\cos A}{2}}$; $\tan\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{1+\cos A}}=\dfrac{1-\cos A}{\sin A}=\dfrac{\sin A}{1+\cos A}$

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QUESTION 1 (25 MARKS)

a) Find the exact value for $\tan\left(\frac{10\pi}{3}\right)\csc\left(\frac{9\pi}{4}\right)-\sin\left(-\frac{11\pi}{6}\right)\cot\left(\frac{9\pi}{4}\right)$. (6 marks)

b) Determine the amplitude, period and phase shift for $y=-\frac{1}{2}\cos\left(3x+\frac{\pi}{2}\right)$. Then, sketch the graph for two period. Clearly show all the x-intercepts. (9 marks)

c) Find all the angles of a triangle with lengths 9.5cm, 14.3cm and 20.7cm. Hence, find the area of the triangle. (10 marks)

QUESTION 2 (25 MARKS)

a) Establish the identity for $\frac{\csc x}{\tan x+\cot x}=\cos x$. (5 marks)

b) Without using calculator, find the exact value of $\tan\left[\sin^{-1}\left(\frac{2}{7}\right)\right]$. (5 marks)

c) Solve $2\sec^2 x+\tan x=3$ for $0^\circ<x<360^\circ$. (6 marks)

d) Given $\cos A=-\frac{3}{7}$, $\pi<A<\frac{3\pi}{2}$ and $\cos B=-\frac{3}{\sqrt{11}}$, $\frac{\pi}{2}<B<\pi$. Find the exact value of $\cos 2B$ and $\tan(A+B)$. (9 marks)

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QUESTION 3 (25 MARKS)

a) Find a rectangular equation for the curve represented by the polar equation $r = \dfrac{2}{3\cos\theta - 3\sin\theta}$. (3 marks)

b) If $x = 2(\cos 34^\circ + i\sin 34^\circ)$, $y = 7(\cos 63^\circ + i\sin 63^\circ)$ and $z = i + 3i$. Find:

i. z in polar form. (3 marks)

ii. $\dfrac{x}{yz^2}$ in rectangular form. (7 marks)

c) Find a vector that is perpendicular to vector $2\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$. (3 marks)

d) Given vectors $\mathbf{a} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = \mathbf{i} + \mathbf{j} - \mathbf{k}$. Find

i. the unit vector in the direction of the vector $\mathbf{a}$. (3 marks)

ii. $\mathbf{b} \times \mathbf{a}$. (4 marks)

iii. $3\mathbf{b} - 2\mathbf{a}$. (2 marks)

QUESTION 4 (25 MARKS)

a) Write the equation of a circle whose diameter is the line segment joining $A(2,7)$ and $B(-10,-3)$. (6 marks)

b) Sketch the graph of $(y-2)^2 = -12(x+4)$ showing clearly the vertex, focus and directrix of the parabola. State the intercepts, if any. (10 marks)

c) Graph the ellipse, locate the center and the foci of the equation:

$$\frac{(x+1)^2}{25} + \frac{(y-3)^2}{64} = 1.$$ (9 marks)

End of Paper